POSTOPERATIVE NAUSEA VOMITING
&
POSTOPERATIVE COGNITIVE DYSFUNCTION

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PONV-Definition

- When patient complains of Nausea and/or vomiting within 24 hours of a surgical procedure that required Anaesthesia.

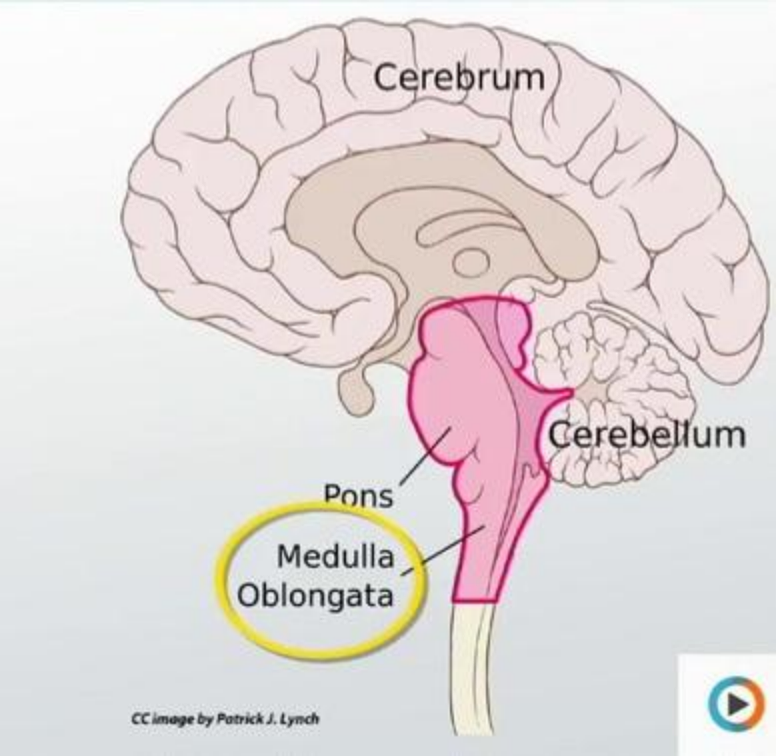
- Subtypes:
  - **Early PONV**: <6 hours after anesthesia.
  - **Late PONV:** 6–24 hours after anesthesia.

VOMITING	NAUSEA
Vomiting (also known as emesis) is the forceful expulsion of the contents of one's stomach through the mouth .	Nausea is a diffuse sensation of unease and discomfort, often perceived as an urge to Vomit.

Pathophysiology

- Vomiting center lies in **Medulla Oblongata**
- Activated by:

  - CRTZ, Vestibular system, GI tract afferents, Cerebral cortex


Cerebrum
Cerebellum
Pons
Medulla Oblongata

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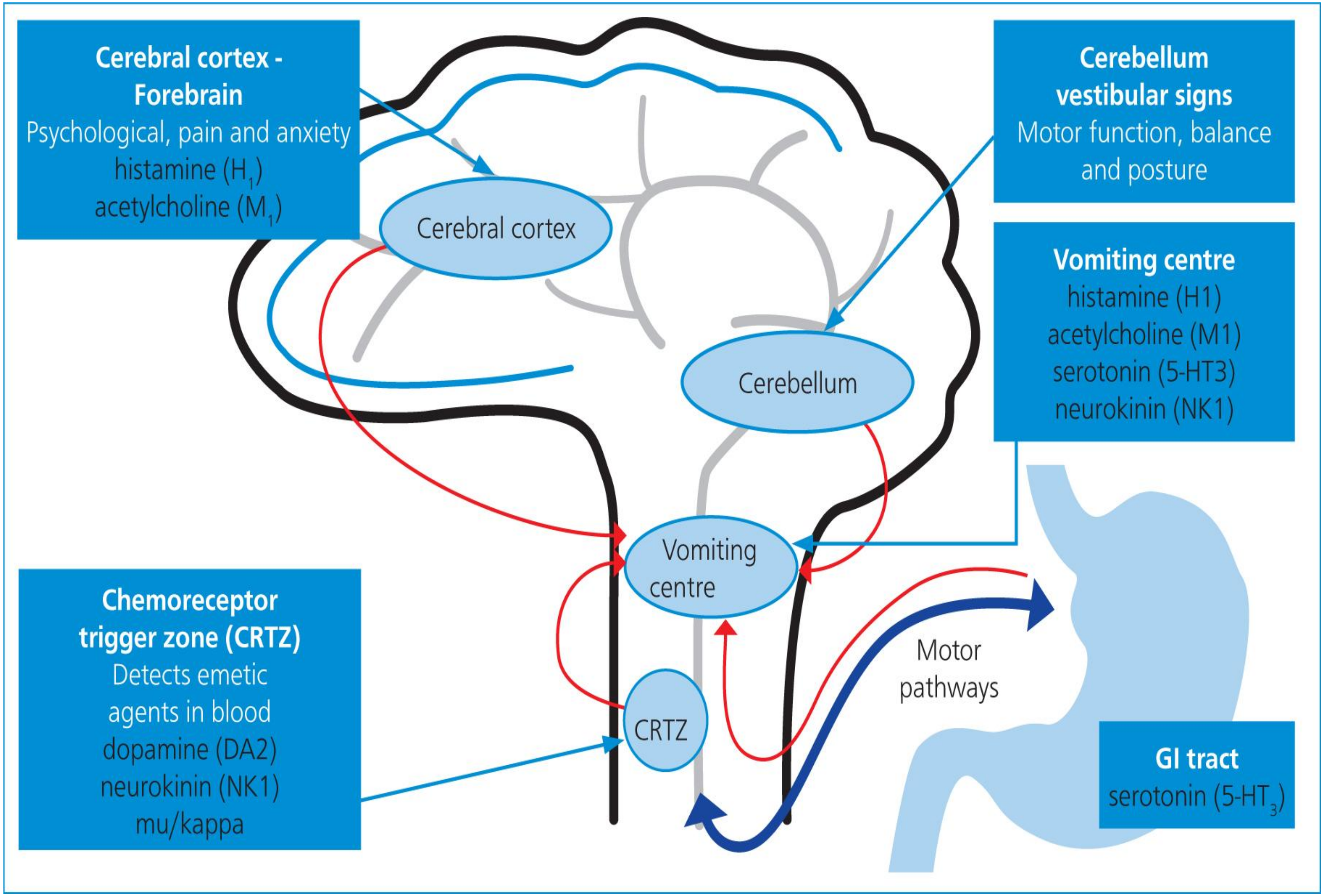

Cerebral cortex
Cerebellum
Vomiting centre
CRTZ
Motor pathways

Cerebral cortex - Forebrain
Psychological, pain and anxiety
histamine (H_1)
acetylcholine (M_1)

Cerebellum vestibular signs
Motor function, balance and posture

Vomiting centre
histamine (H1)
acetylcholine (M1)
serotonin (5-HT3)
neurokinin (NK1)

Chemoreceptor trigger zone (CRTZ)
Detects emetic agents in blood
dopamine (DA2)
neurokinin (NK1)
mu/kappa

GI tract
serotonin (5-HT$_3$)

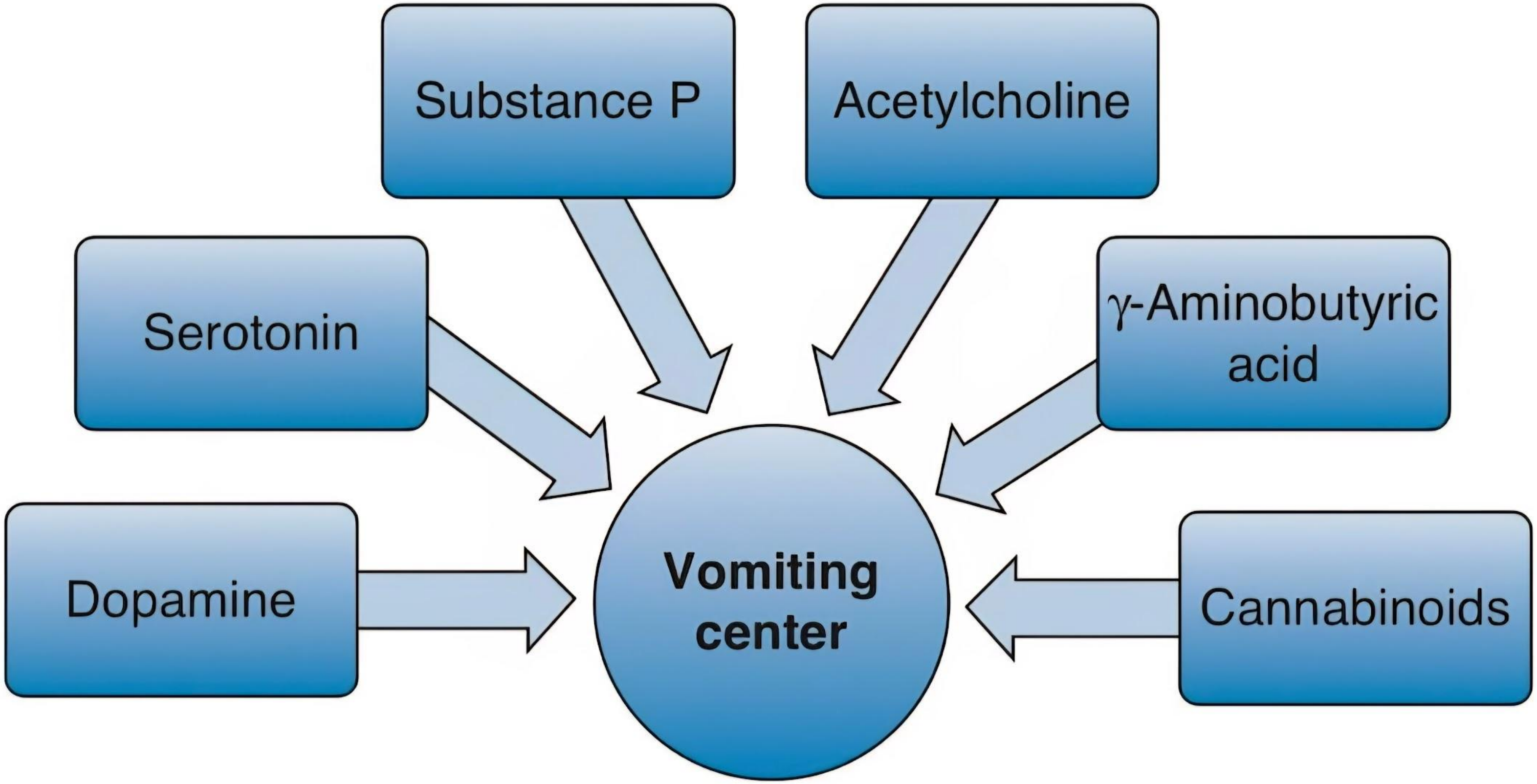

Substance P
Acetylcholine
Serotonin
γ-Aminobutyric acid
Dopamine
Vomiting center
Cannabinoids

FIgure 34-1 Pharmacological systems that interact with the vomiting center.

Upon activation, the vomiting center sends efferent signals via

- the cranial nerves V, VII, IX, X, and XII to upper GIT
- the vagal parasympathetic fibers and sympathetic chain to lower tract
- spinal nerves to Diaphragm and abdominal muscles

Increase of salivary gland fluids

↓

Deep breath (to avoid aspiration)

↓

GI retroperistalsis (small intestine, pyloric sphincter)

↓

Decreased intrathoracic pressure (inspiration against a closed glottis)

↓

Retching

↓

Vomiting

↓

SNS response (increased HR, sweating)

Risk Factors

Patient factors:

- Female (because of effects of estrogen and progesterone on CTZ)
- Non-smokers
- Motion sickness
- PONV history
- Age weakly associated with PONV ;However risk is reduced with ageing.

Surgical Factors:

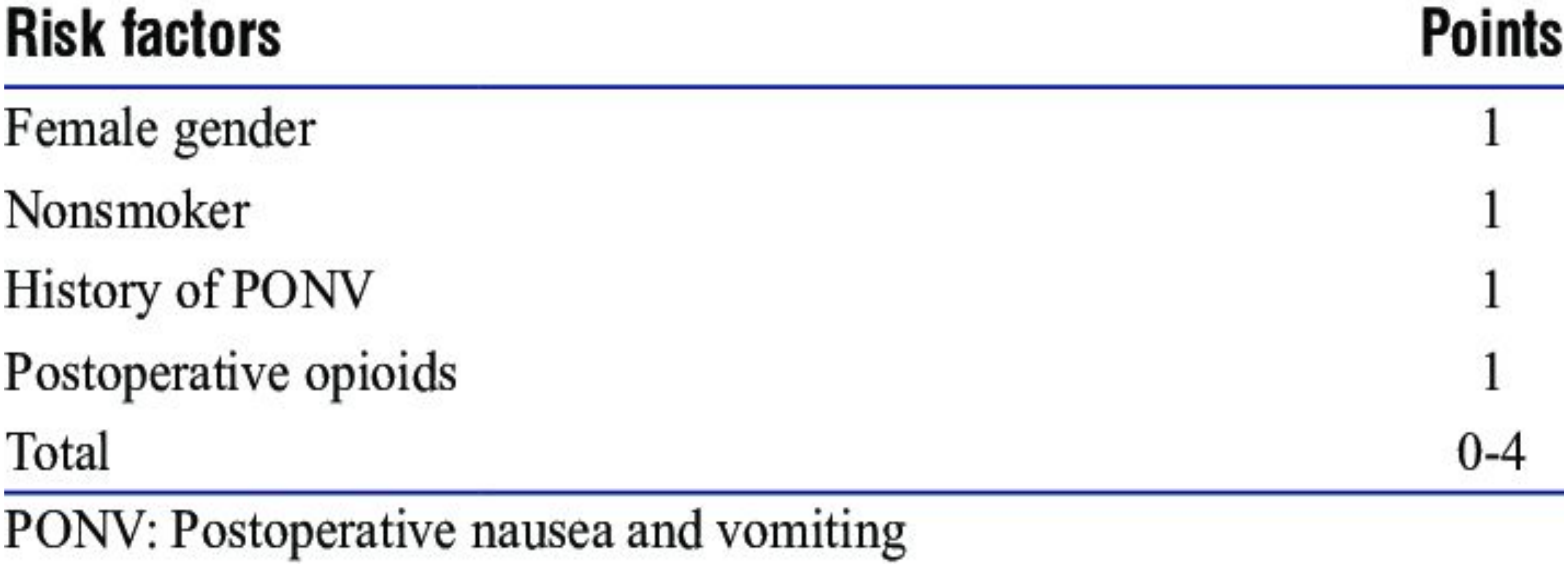
- Long duration surgical procedure
- ENT surgeries
- laparoscopic procedures
- Strabismus surgeries in children

Anaesthetic Factors:

- Duration of Anaesthesia
- Inhalational anaesthetic agent - Nitrous Oxide
- Neostigmine
- Opioids

APFEL SCORE

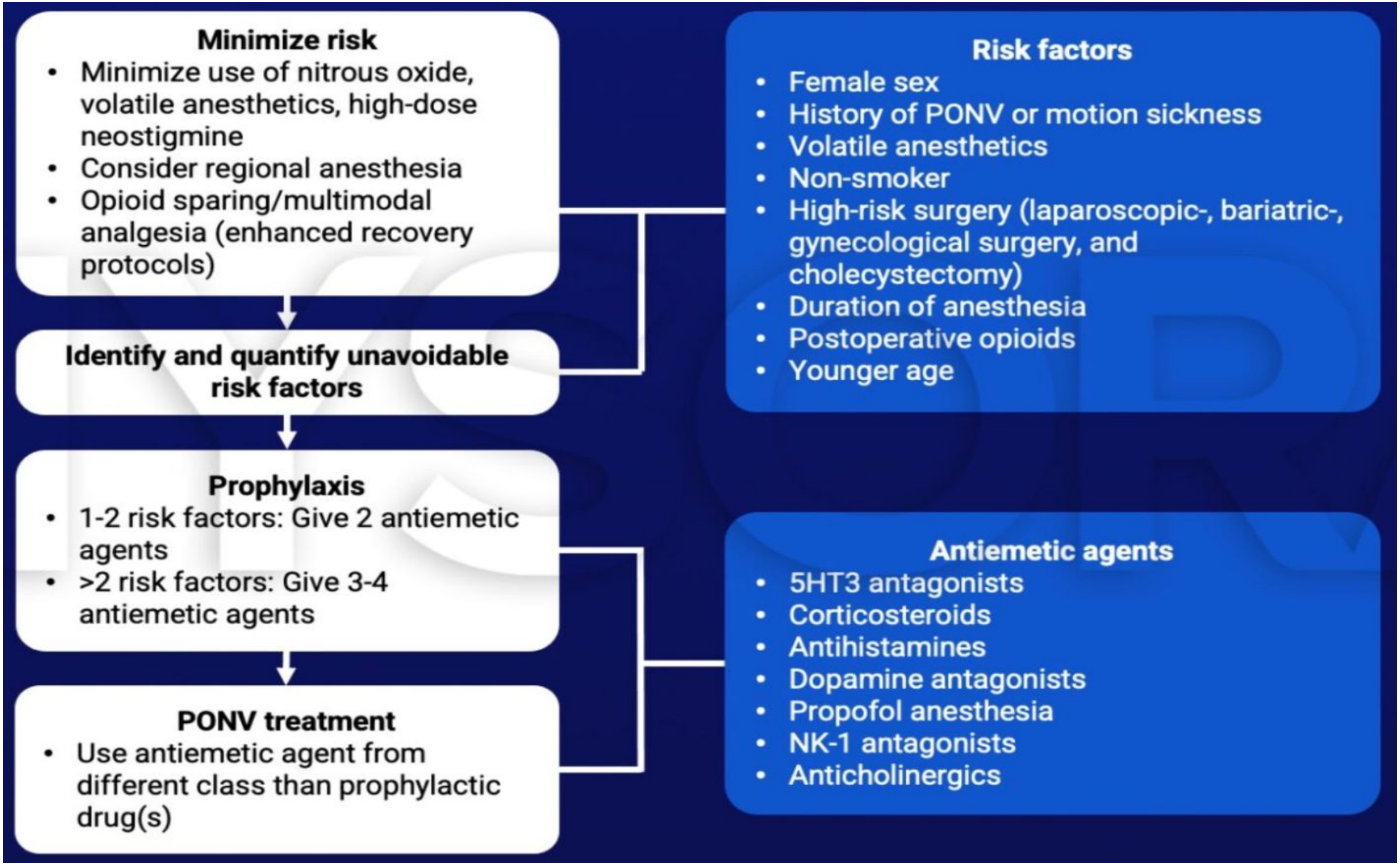
It is a risk stratification tool used to predict PONV in patients undergoing surgeries.



Risk factors	Points
Female gender	1
Nonsmoker	1
History of PONV	1
Postoperative opioids	1
Total	0-4

PONV: Postoperative nausea and vomiting

POSTOPERATIVE NAUSEA AND VOMITING (PONV) MANAGEMENT



Minimize risk

- Minimize use of nitrous oxide, volatile anesthetics, high-dose neostigmine
- Consider regional anesthesia
- Opioid sparing/multimodal analgesia (enhanced recovery protocols)

Identify and quantify unavoidable risk factors

Prophylaxis

- 1-2 risk factors: Give 2 antiemetic agents
- >2 risk factors: Give 3-4 antiemetic agents

PONV treatment

- Use antiemetic agent from different class than prophylactic drug(s)

Risk factors

- Female sex
- History of PONV or motion sickness
- Volatile anesthetics
- Non-smoker
- High-risk surgery (laparoscopic-, bariatric-, gynecological surgery, and cholecystectomy)
- Duration of anesthesia
- Postoperative opioids
- Younger age

Antiemetic agents

- 5HT3 antagonists
- Corticosteroids
- Antihistamines
- Dopamine antagonists
- Propofol anesthesia
- NK-1 antagonists
- Anticholinergics

PONV in children

- Age >3 years
- History of PONV/motion sickness
- Family history of PONV
- Post-pubertal female
- High-risk surgery (strabismus adenotonsillectomy, otoplasty)
- Volatile anesthetics

Management of PONV in children

Dexamethasone and 5HT antagonists are the antiemetics of choice in children:

- 0 risk factor - No prophylaxis
- 1-2 risk factors

  - Dexamethasone and 5HT3 antagonist
- >2 risk factors

  Dexamethasone and 5HT3 antagonist + consider total intravenous anesthesia

Table 34-1

Pharmacologic Therapies for Treatment of Nausea and Vomiting

Anticholinergics	Atropine Hyoscine Scopolamine
Benzamides	Metoclopramide
Benzodiazepines	Midazolam
Butyrophenones	Droperidol Haloperidol
Cannabinoids	Dronabinol Nabilone
Glucocorticoids	Dexamethasone
5-HT$_3$ antagonists	Dolasetron Granisetron Ondansetron Palonosetron Ramosetron Tropisetron
Neurokinin-1 antagonists	Aprepitant Fosaprepitant
Phenothiazines	Prochlorperazine Promethazine Chlorpromazine

Anticholinergics

Scopolamine

- Prevention of Motion-Induced Nausea
- Postoperative Nausea and Vomiting
- Transdermal absorption of scopolamine provides sustained therapeutic plasma concentrations
- morphine and synthetic opioids increase vestibular sensitivity.
- Protection against motion-induced nausea is greatest if the transdermal application of scopolamine is initiated at least 4 hours before the noxious stimulus

Dexamethasone

- central inhibition of prostaglandins and endorphins release
- Obese and diabetic patients are at increased risk for perioperative hyperglycemia

BENZAMIDES:

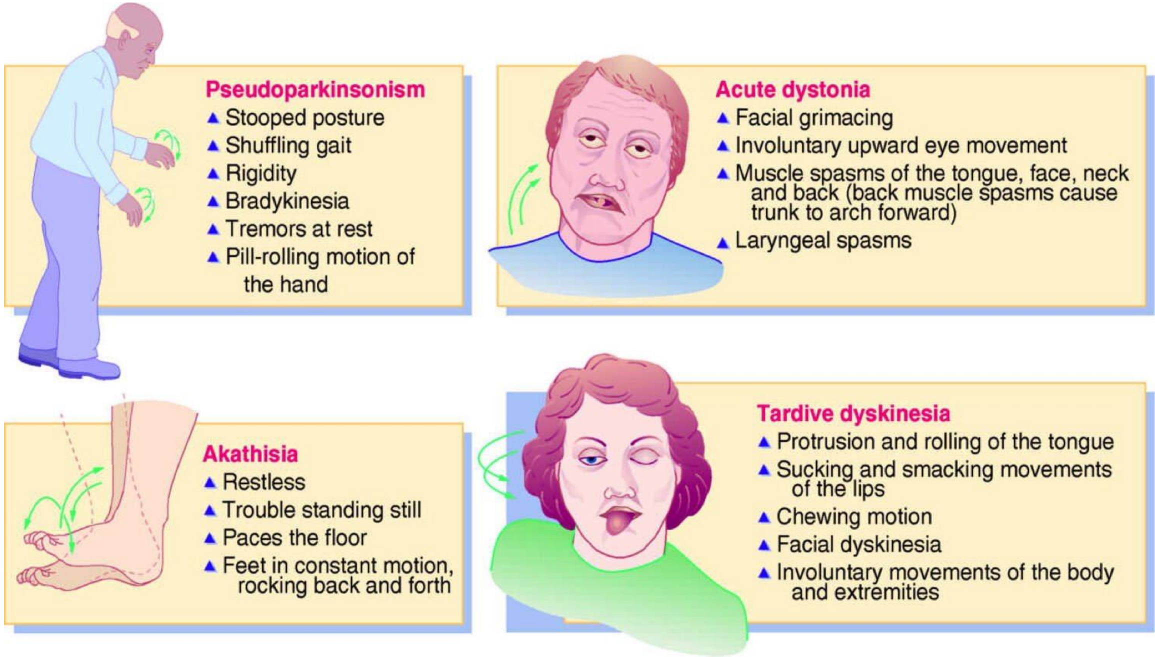
METOCLOPRAMIDE AND DOMPERIDONE

- contraction of the lower esophageal sphincter and gastric fundus
- increased gastric and small intestinal motility
- decreased muscle activity in the pylorus and duodenum when the stomach contracts.
- Metoclopramide crosses the blood–brain barrier have direct effects on the CRTZ and/or vomiting center because of its antidopaminergic effect.

METOCLOPRAMIDE

Because of its antidopaminergic activity, metoclopramide should be used with caution in patients with Parkinson’s disease or who have movement disorders related to dopamine inhibition.

Extrapyramidal symptoms



Pseudoparkinsonism
- Stooped posture
- Shuffling gait
- Rigidity
- Bradykinesia
- Tremors at rest
- Pill-rolling motion of the hand

Acute dystonia
- Facial grimacing
- Involuntary upward eye movement
- Muscle spasms of the tongue, face, neck and back (back muscle spasms cause trunk to arch forward)
- Laryngeal spasms

Akathisia
- Restless
- Trouble standing still
- Paces the floor
- Feet in constant motion, rocking back and forth

Tardive dyskinesia
- Protrusion and rolling of the tongue
- Sucking and smacking movements of the lips
- Chewing motion
- Facial dyskinesia
- Involuntary movements of the body and extremities

BENZODIAZEPINES:

MIDAZOLAM:

- decrease synthesis and release of dopamine within CRTZ
- **S/E**- drowsiness
  - dizziness

BUTYROPHENONES:

Droperidol and Haloperidol

-Antidopaminergic action

- **Haloperidol**

  -antiemetic properties when used in low doses, 0.5 to 2 mg IV

  -S/E :Extrapyramidal signs

- **DROPERIDOL**
  - -black box restrictions due to its association with prolonged QT syndromes (usually at higher doses)
  - -at low doses used as rescue therapy as an antiemetic.
  - -Prophylactic dose of droperidol - 0.625 to 1.25 mg IV , effective for the prevention and treatment of PONV

5-HT3 Antagonists

- Serotonin is released from the enterochromaffin cells of the small intestine → stimulates the vagal afferents through 5-HT3 receptors →initiates the vomiting reflex.
- Antagonism of 5-HT3 receptors results in an antiemetic effect

5-HT3 Receptor Antagonists:

Ondansetron, Tropisetron, Granisetron, palonosetron

- highly effective in the prevention and treatment of PONV
- prophylaxis and treatment of chemotherapy- & radiation therapy– induced nausea and vomiting

Ondansetron

- DOSE-4 to 8 mg IV (administered over 2 to 5 minutes immediately before the induction of anesthesia), is highly effective in decreasing the incidence of PONV .

S/E: headache and diarrhea

- **Tropisetron:**
  - -prevention of PONV when administered (2 to 5 mg IV) before the induction of general anesthesia
- **Granisetron:**
  - - Dose - 0.02 to 0.04 mg/kg IV
  - -Side effects are mild and include headache, sedation, and diarrhea.
- **Palonosetron**
  - -Dose-0.02 mg/kg IV

Histamine Receptor Antagonists

- Histamine through H1 receptors and inositol phospholipid hydrolysis evokes smooth muscle contraction in the gastrointestinal tract.
- Antihistamines acting on H1 receptors **-diphenhydramine, dimenhydrinate, cyclizine, promethazine**

- Dose -dimenhydrinate 20 m g IV

Postoperative Cognitive Dysfunction (POCD)

- POCD is a neurodegenerative condition, acquired after surgery and anaesthesia

- An acute and fluctuating alteration of mental state of reduced awareness and disturbance of attention.

- The incidence of POD depends on peri- and intraoperative risk factors and is highly variable

- **Acute POCD**

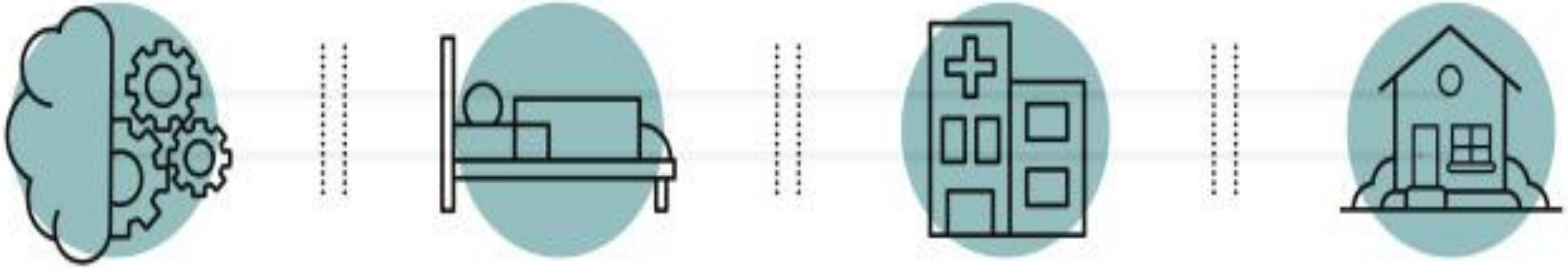
  Develops with in a week of surgery (associated with higher mortality)
- **Intermediate POCD**

  Develops within 3 months following surgery (most common)
- **Long term POCD/persistent POCD**

  Develops 1-2 year following surgery 1% of patients have persistent POCD

Timeline of cognitive decline

After surgery and anaesthesia



Before to surgery	Within 7 days	Within 30 days	Within 12 months
Neurocognitive disorder (mild or major)	**Postoperative delirium**	**Delayed neurocognitive recovery**	**Postoperative neurocognitive disorder**

DELIRIUM	POCD
Acute	Chronic
Rapid onset	-variable to insidious
fluctuation	- not fluctuating
clouded consciousness -	-no clouding of consciousness

POCD SYMPTOMS:

- Memory impairment
- Impaired performance on intellectual tasks
- Loss of concentration
- Short attention span
- Personality changes
- Social interaction changes
- Disorientation
- Loss of perception
- Depression

Pathophysiology of POCD:

Multifactorial origin:

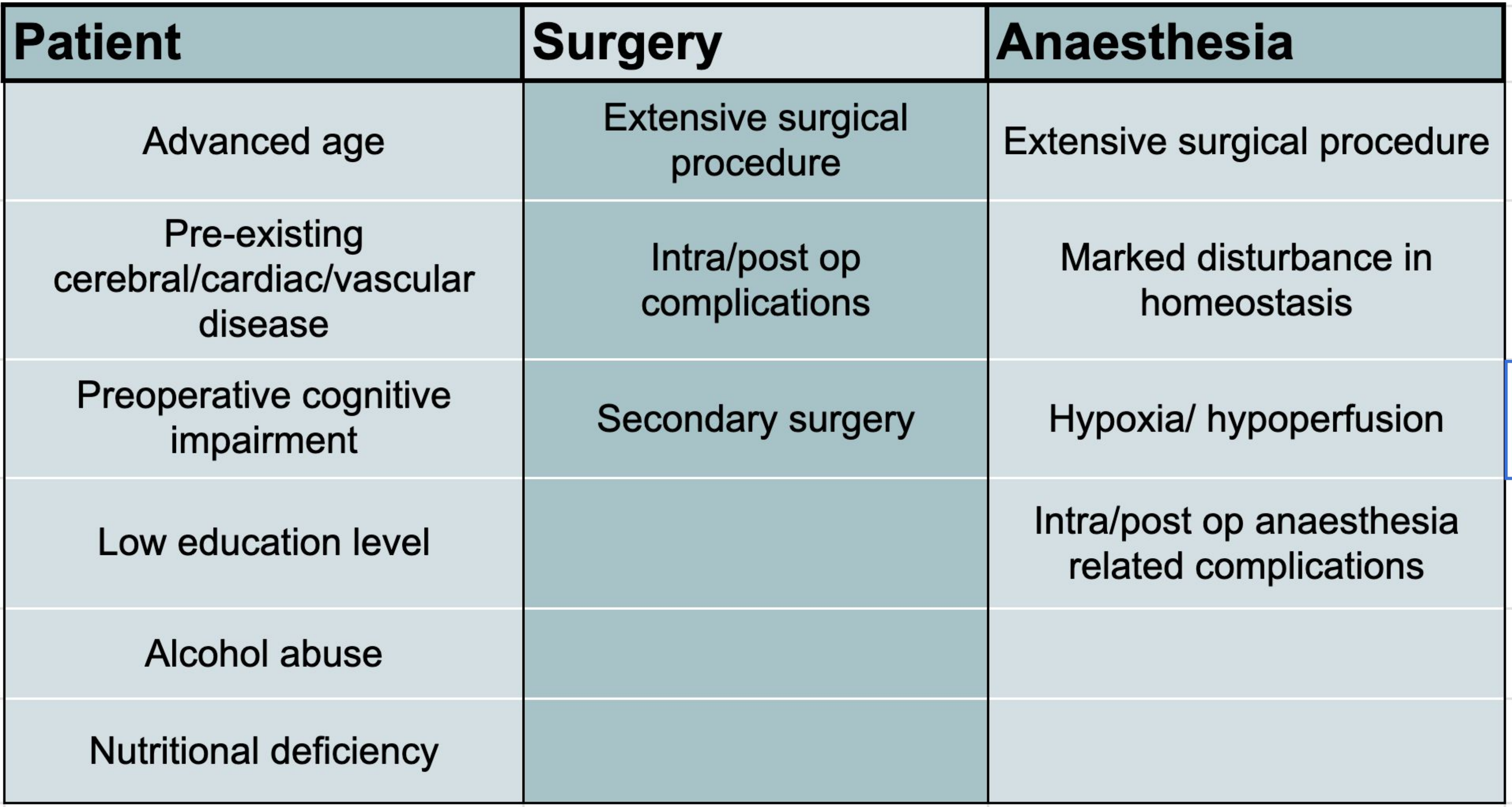
- Neuroinflammation (cytokines, microglial activation)

- Hypoperfusion or embolic events

- Blood-brain barrier disruption

- Anesthesia-related neurotoxicity

RISK FACTORS FOR POCD:



Patient	**Surgery**	**Anaesthesia**
Advanced age	Extensive surgical procedure	Extensive surgical procedure
Pre-existing cerebral/cardiac/vascular disease	Intra/post op complications	Marked disturbance in homeostasis
Preoperative cognitive impairment	Secondary surgery	Hypoxia/ hypoperfusion
Low education level		Intra/post op anaesthesia related complications
Alcohol abuse		
Nutritional deficiency		

DIAGNOSIS AND ASSESSMENT

- **Screening Tools:**
  - Mini-Mental State Examination (MMSE)
- Family and caregiver reports: Families often notice cognitive changes before the clinical team.
- **Importance of preoperative cognitive screening:** Identifies high-risk patients for POCD.

Mini-Mental Status Examination (MMSE)	Maximum Score
Orientation	
1. What is the year? Season? Date? Day? Month?	**5**
2. Where are we? State? County? City? Hospital? Floor?	**5**
Registration	
3. Name three objects. Ask the patient to name the items. Repeat the answers until the patient learns all three.	**3**
Attention and Calculation	
4. Serial sevens (ask the patient to begin with 100 and count backwards by sevens, stopping after five subtractions: 93, 86, 79, 72, 65). Or spell "world" backwards	**5**
Recall	
5. Ask the patient to name the three objects learned under "registration" above.	**3**
Language	
6. Point to a pencil and a watch, asking the patient to name both items.	**2**
7. Have the patient repeat "no ifs, ands, or buts".	**1**
8. Have the patient follow a three-stage command. For example, say "take a paper in your right hand. Fold the paper in half. Put the paper on the floor".	**3**
9. Have the patient read and obey the following sentence, written in large letters: "close your eyes".	**1**
10. Have the patient write a sentence.	**1**
11. Have the patient copy a picture of two intersecting pentagons	**1**
Total	**30**

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Interpretation of the MMSE score:

MMSE score	**Degree of impairment**
26–30	Questionably significant
20–25	Mild
10–19	Moderate
0–10	Severe

PROPHYLAXIS & Management of POCD:

Preoperative optimization/ Prehabilitation

- Inspiratory muscle training
- Control of cardiovascular risk factor
- Nutritional optimization -Vitamin B12/Folic acid / Homocysteine , Vitamin D
- Correcting Anaemia
- Correcting electrolyte imbalance
- Cognitive prehabilitation

Intraoperative strategy to prevent POCD

- Avoidance of prolonged fasting
- Avoidance of sedative premedication
- Use of short acting opioid
- Optimal depth of anaesthesia
- Maintenance of adequate cerebral oxygenation
- Avoidance of benzodiazepines and anticholinergic

. Avoiding Hypoxia/hypotension/hypothermia

Postoperative strategy

Multi component non pharmacological intervention

- Early mobilization & exercise
- Cognitive stimulation
- Support of circadian rhythms
- Good hygiene
- Vision & hearing aid (if required)
- Avoidance of high risk drugs

- The medication of choice is **Haloperidol**

  Dose - 0.5 to 1 mg IM/IV
- Atypical antipsychotics like risperidone, olanzapine, quetiapine, or ziprasidone can also be used

THANK YOU